QHeatNet Phase II: Experimental Viability and Simulation of Thermodynamic Quantum Lattices

Abstract

This Phase II paper expands upon the foundational theory of QHeatNet, which proposes that quantum entanglement may operate across a thermodynamic substrate rooted in the Cosmic Microwave Background (CMB). Here, we explore the experimental and computational pathways for testing this model. We propose a thermal analog lattice for simulating CMB-style coherence, outline potential entropy-based phase synchronization mechanisms, and introduce the QHeatSim model—a computational framework for validating field-wide information resonance without photonic mediation. If demonstrated, QHeatNet may open a new frontier in quantum communication and entropic computation.

1. Introduction

The QHeatNet framework introduces a paradigm in which entangled states are synchronized through a common entropy field rather than signal-based propagation. In this follow-up, we provide a roadmap for scientific verification, focusing on two core objectives: (1) the design of experimental setups that can simulate entropic phase coupling, and (2) the development of mathematical and computational models capable of validating coherence behavior over simulated CMB-inspired thermal grids.

2. Experimental Proposal

We propose constructing a thermal coherence lattice using phase-controllable microwave emitters arranged in a uniform grid. This lattice would replicate CMB-like uniformity and allow precise manipulation of entropy gradients via localized thermal shifts. Pairs of quantum sensors (e.g. NV centers or trapped ions) would be placed at lattice nodes to measure nonlocal state correlation in response to entropic phase manipulation, with no classical signal connection. The experiment would test whether entropy alignment can induce synchronized quantum behavior.

3. Computational Simulation Framework (QHeatSim)

QHeatSim is a proposed simulation engine that models quantum state nodes on a thermodynamic grid using entropy-based state transitions. Nodes are updated not by direct signal but by their alignment with a shared entropy field E(x,t), governed by discrete gradient propagation:

$$E_{ij}(t+1) = E_{ij}(t) + \alpha \nabla S_{ij} - \beta \Delta \Phi_{ij}$$

where ∇S_{ij} is the entropy gradient, $\Delta\Phi_{ij}$ is the phase deviation from equilibrium, α and β are coupling coefficients. Synchrony is measured by global fidelity:

$$F_{total} = \Sigma |\Psi_i(t) - \Psi_j(t)|^2 / N$$

A drop in F_{total} upon thermal alignment would indicate nonlocal correlation effects.

4. Metrics for Validation

To validate the QHeatNet hypothesis, we define the following experimental thresholds:

- $\Delta F > 10^{-2}$ in fidelity after entropy phase alignment
- Consistency across $>10^4$ lattice trials
- Phase locking between nodes with zero direct signal input
- Reversibility of alignment based on thermal pattern shifts

Additional simulations will test behavior under CMB-modeled noise and initial condition randomness to simulate cosmic uniformity.

5. Future Applications

A successful demonstration of QHeatNet principles would enable a range of technologies:

- Long-distance, light-speed-independent quantum communication
- Distributed entropy-based processors
- Secure quantum synchronization platforms
- Cosmological computing models that treat entropy fields as logical frameworks

Furthermore, the QHeatNet approach could integrate into AI cognition layers that use nonlocal coherence as a memory field.

6. Conclusion

QHeatNet Phase II marks a transition from speculative theory to scientific strategy. Through experimental proposals, simulation frameworks, and rigorous validation metrics, we aim to demonstrate the plausibility of entropy-linked entanglement via thermodynamic phase coherence. We welcome scientific engagement, critique, and collaboration in testing and refining this frontier model.

References

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